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AN ESSAY ON THE CONSTRUCTION AND BUILDING OF CHIMNEYS.

INCLUDING

An ENQUIRY into the common CAUSES
of their SMOAKING,

AND

The moſt effectual REMEDIES for removing ſo intolerable a NUISANCE;

WITH

A TABLE to proportion CHIMNEYS to the Size of
the ROOM.

Illuſtrated with proper FIGURES.

By ROBERT CLAVERING, Builder.

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BRITISH MUSEUM

INTRODUCTION.

THE following tract is directed to the inveſtigation of an eſſential article in building, not hitherto conſidered ſo minutely as the importance of the ſubject deſerves.

It is not to be mentioned without aſtoniſhment, that ſo many able and ingenious artiſts, who have travelled over Europe to acquire knowledge in architecture, and who have deſigned and erected buildings in this country, far ſuperior for ſtrength, lightneſs, and elegance, to any that are to be found abroad; ſhould, nevertheleſs, have neglected to aſcertain the principles of a conveniency, the due execution of which is neceſſary to render every habitation comfortable, from the cottage to the palace! Nor is it leſs ſurpriſing, that the laudable Society inſtituted for the Encouragement of Arts, Manufactures, and Commerce, among all their liberal premiums for diſcoveries of public utility, have never offered encouragement for the beſt regular theory of the conſtruction and building of chimneys!

My thoughts firſt turned to this ſubject in the year 1764, whereon I conſulted ſeveral able bricklayers, but failed in receiving any ſatisfactory information: they all differed in opinion, particularly in reſpect to gathering the breaſt and wings of chimnies, and in the ſize and direction of the funnels, without aſſigning any ſubſtantial reaſon, why they ſhould be conſtructed one way rather than another; ſaying only, ſuch was the beſt way, and they always did ſo themſelves.

As I was then engaged in building ſeveral houſes, I began to try experiments; and if they were not attended at firſt with poſitive ſucceſs, they led to important diſcoveries, which immediately enabled me to find where ſome defects lay, and to make many uſeful remarks.

About the year 1767, I met with Dr.

Mead's account of Sutton's ingenious pipes, for extracting foul air out of ſhips, to which I was indebted for my firſt knowledge of the properties of air and vapour, and their powerful rarefaction by fire. I afterwards met with Sutton's Treatiſe on Smoky Chimneys, but here I found him erroneous in many reſpects, particularly in his directions for conſtructing chimneys, which I knew by experience to be wrong.—I then read ſeveral of the beſt phyſical and mechanical authors on air, fire, &c. and having opportunity at that time, I made ſeveral trials reſpecting chimnies, with better ſucceſs than before.

In my further reſearches, I met with the late Edinburgh *Encyclopædia Britannica*, wherein, under the article of ſmoke, I received great information. In ſhort, I have read every author I could find on the ſubject, or any ways relating thereto, and in the whole courſe of my practice in building, I have never neglected any opportunity of making remarks and obſervations from experience on the many buildings I have ſurveyed and inſpected.

I am very ſenſible I run no ſmall riſque of cenſure, from ſome of the lower order of ſurveyors, and more particularly from the whole tribe of advertiſing chimney doctors: we know by general experience, that every innovation in common uſage, before the utility is demonſtrated, is laughed at by intereſted ſnarlers, and the daring authors of them treated as fools and madmen. This is the fate of all projectors, good and bad, and as they commonly die (as Pope ſays) without the reward of *ſolid pudding*, ſo they do not always live even to reap the ſatisfaction of hearing the *empty praiſe* * afterwards beſtowed upon their labours. However, from GENTLEMEN of ſuperior knowledge, and from ingenious and experienced artiſts, more liberal treatment and more mature deciſion may be expected.

I well know the great difficulty there will be in procuring chimneys to be executed on the principles here recommended; for conceited ſurveyors and maſter bricklayers, who

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*———Truth, with gold ſhe weighs,
And ſolid pudding, againſt empty praiſe.

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think themſelves inſulted by receiving direction; and ignorant workmen, who are confounded, and of courſe become refractory, if put out of their old methods, will unite in a confederacy to thwart the intentions of their employers, and rejoice with malignant pleaſure, if they ſucceed in effecting his diſappointment. Nevertheleſs, I adviſe gentlemen by no means to be argued, or rather teaſed out of a plan that carries conviction with it, by obſtinate ignorance. There are many experienced and ingenious bricklayers to be found, willing and capable to execute any judicious orders, in the moſt perfect and ſubſtantial manner. I have conſulted ſeveral able workmen on the ſubject, particularly on gathering the wings and making circular funnels to the chimnies, who all agree they may be eaſily executed by more methods than one.

I leave the utility of this performance to the impartial judgment of the public, aſſuring them, that the pleaſure I ſhall receive from their approbation, will be meaſured by the benefit they may receive from my labours.

ROBERT CLAVERING.

July 10*th*, 1779.

BRITISH
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MUSEUM

A
DISSERTATION
On the CONSTRUCTION of
CHIMNIES.

NO ſituation in life can be more uncomfortable and unhealthy than reſiding in a ſmoky houſe: it is not only offenſive to our ſenſations, but deſtroys all domeſtic enjoyment. Rooms ever ſo beautifully decorated, are, in this caſe, always dirty, and the moſt ſuperb furniture is ſpoiled.

It is the moſt eſſential, and ought to be the principal object with the architect and builder, to conſtruct and execute chimneys on ſuch a plan as to convey up all the ſmoke.

But it is evident that the moſt eminent architects have never properly aſcertained the true principles of giving a proper draught to a chimney, or they would not, at this time, disfigure the chimney tops on the moſt ſplendid and magnificent edifices, with pots. They are diſgraceful in appearance, and indicate a deficiency of ſkill, not to be pardoned; as chimney ſhafts may be finiſhed, in the trueſt taſte, without ſuch clumſy expedients. To a well conſtructed funnel they are very injurious, and are, beſides, attended with a long train of diſagreeable, and even dangerous circumſtances; being only uſeful in peculiar ſituations.

The various experiments that have been tried by pretenders, who have undertaken the cure of ſmoky chimneys, are beyond conception! But, unfortunately, theſe contrivances have been the random attempts of ignorant men, wholly unacquainted with the phyſical cauſe of the aſcent of vapour; namely, the powerful rarefaction of air by heat.

There is not any branch, perhaps, of natural philoſophy that has more engaged the attention of the learned, or been more ſucceſsfully cultivated of late, than the nature of air; and this in almoſt every circumſtance whatſoever, excepting the application of it to the doctrine of chimnies.

The preſent deſign, therefore, is to ſupply this defect, by giving plain and eaſy directions for conſtructing and executing chimnies; which, if attentively obſerved, will put an end to the nuiſances ſo juſtly complained of at preſent.——For the more clearly comprehending the ſeveral principles relating to this ſubject, it will be neceſſary to explain the general nature and operation of fire and air, the agents in conveying ſmoke through thoſe channels, which conſtitute the ſubject of our diſſertation.

Fire is an agent, of which the power is great, its effects extenſive, and the manner of its acting wonderful. Philoſophers are much divided in their opinions concerning the origin and nature of it; but the diſcuſſion of theſe would be tedious, and foreign to our purpoſe, which is only to conſider its effects.

There ſeems to be no other difference between fire and flame, than, that fire conſiſts in a glowing degree of velocity in the parts of a body, while yet ſubſiſting in the maſs; and that flame is the ſame degree of velocity extended to the detached particles, whilſt flying off in exhalation. In brief, flame is red hot ſmoke.

The ſmoke of coals is more groſs, unctuous, and weighty, than that of wood, turf, or any other common fuel; it therefore adheres to the ſides of chimnies in its paſſage, in the form of ſoot, in a larger proportion.

Air poſſeſſes ſome qualities peculiar to itſelf, but is ſubject, in general, to the ſame phyſical laws with other fluids. Thoſe properties which we are now more immediately concerned in, are, firſt, its weight, or gravity; ſecondly, its condenſation; thirdly, its fluidity; fourthly, its rarefaction; and fifthly, its elaſticity.

Firſt, that the air gravitates, or acts upon inferior bodies, is evident, from numberleſs experiments of the air-pump and barometer.

The weight of air is continually changing, in proportion to the different degrees of heat or cold, &c. by which it is affected; and this weight is greater, the nearer it is to the earth's ſurface, becauſe the lower regions of the air ſuſtain the preſſure of the whole ſuperior body of the atmoſphere.——(Vide Sir Iſaac Newton's Optics.)

Secondly, Mr. Boyle, by various experiments, proves that air may be condenſed ſo as to occupy but $\frac{1}{60}$ part of the ſpace it poſſeſſed before. It is found that the power of its elaſticity is according to its denſity, and its denſity is found, by experiments, to be equal to its compreſſion.

Thirdly, that air is a fluid is evident, by its yielding to every force.

Fourthly, it is proved, by computation, that the air at ſeven miles altitude from the earth, is four times rarer, thinner, and of courſe, lighter, than at the ſurface; and at fourteen miles altitude, ſixteen times rarer; at twenty-one miles, ſixty-four times, and ſo on, in geometrical proportion of rarety, compared with the arithmetical proportion of its altitude. (Vide Sir Iſaac Newton's Optics, page 342.)

That air is rarefied by the fire is evident, by the experiment of an empty bladder, tied cloſe at its neck, and laid before a fire; which will ſo rarefy the little incloſed air, as to diſtend the bladder to its utmoſt ſtretch, and at laſt burſt it, with a report equal to that of a piſtol.

Fifthly, the elaſticity of a body is its property of returning forcibly and ſpontaneouſly to its original ſtate immediately after it hath been altered, by a force applied to it; and is called the ſpring, or re-action of the body; and this property is peculiarly obſervable in air.

As the air is compreſſible by art, ſo is it contracted by cold, and expanded by heat: hence its denſity is always in proportion to its natural temperature as to cold or heat.

To bring this doctrine home to our ſubject, it will be neceſſary to obſerve the following effects of fire on the air in rooms, &c. where it is placed.

If in a middle-ſized room, with two fire places, a large briſk fire is made in one, (the doors and windows being ſhut) it will ſoon bring the air down the other chimney with ſuch force as to put out a candle. If fires are kindled in both, and there are any cloſets or cavities in the room, it will draw the air from them with the ſame velocity; or if a door be ſhut (but not faſtened) it will open a little by the draught of air inward. When the fires are both put out, and the room cooled, it will, on the contrary, ſhut cloſe of itſelf. Again, if the funnel of one of the chimnies is ſtopped up, the ſmoke will direct its courſe to the other fire-place immediately.

Theſe fires are only fed and preſerved by a conſtant draught of air, which being rarefied by the fire, and ruſhing up the chimney, conveys the ſmoke along with it into the higher regions of the atmoſphere: but if the funnels are cloſely ſtopped up, together with the doors and windows belonging to the room, the fires will immediately die away, and at laſt go out.

Sir John Pringle, the late preſident of the Royal Society, in his diſcourſe on air, delivered at the anniverſary meeting, November 30, 1773, ſays, page 22, "It is well known that flame cannot long ſubſiſt without a renewal of common air. The quantity of that fluid which even a ſmall flame requires is ſurpriſing: an ordinary candle conſumes, as it is called, about a gallon of air in a minute."

If there is a large fire in a room, and the door opened a little, ſo as to admit it to draw, hold a candle at the top of the door, and the air will drive the flame outwards; hold the candle in the middle, there will be no draught at all; but if it is held at the bottom, the air will drive the flame in toward the fire. This proves the rarefaction of the air by heat; and that the property of rarefied air is to aſcend, from the diminution of its gravity. The following inference may be drawn from this experiment; that fire can neither be collected, preſerved, increaſed, or regulated without air; conſequently, our endeavours muſt be directed to regulate the courſe of it, with reference to the chimney.

From theſe principles, it is obvious, that a fire once lighted in a room is preſerved by a conſtant draught of air from the room; and the air at the opening of the chimney below being effectually heated and rarefied, will directly aſcend, and carry off the ſmoke through the funnel provided over it, to the top of the building: the action of the fire at the lower extremity of the funnel, being ſtronger than the cold external air at the aperture above. The external air will ſucceſſively preſs in at all openings in the room below, which forcing back the flame and ſmoke in the fire-place to the back of the chimney, will become equally elaſtic and rarefied with them, and aſcend up the chimney with great rapidity. Thus an equilibrium with the external air is maintained by the fire, if it meets with no impediment by defects in the funnel.

From what has been ſtated, the following corollaries naturally ariſe:

Firſt, that before a fire is lighted, the chimney contains a body of cold, condenſed, and ſtagnated air, which, according to the laws of nature, is in a ſtate of reſt; but the fire being made, becomes the ſeat, or center of motion, by rarefying the air in the mouth of the chimney: this acts againſt the ſtagnated air in the funnel, producing a current, which continues as long as the fire is kept up, more or leſs, according to the degree of heat.

Secondly, it is alſo evident, that the more the air is heated and rarefied, with the greater celerity it will aſcend. Therefore the nearer the air is made to paſs the fire, the more heated and rarefied it will be.

Thirdly, that the rarefied air will aſcend through the chimney nearly of an equal degree of heat, to the top of the funnel, if not prevented by any unnatural obſtruction in the funnel; is clear, from daily obſervations.——Hence it follows, that a chimney ſhould be conſtructed and proportioned in all its parts, according to the ſize of the room, and erected with the greateſt care and circumſpection.——Theſe obſervations are founded on principles too obvious and certain to be denied, without, at the ſame time, denying that the laws of nature are uniform, or ſuppoſing the effect greater than the cauſe, which is impoſſible.

Having thus far explained the nature and operations of fire and air, relating to this branch of our ſubject, we will proceed to the ſeveral cauſes of ſmoky apartments, and point out the errors, both internally and externally, as to the conſtruction and poſition of chimneys.

OBSERVATIONS

ON

SMOKY CHIMNIES.

IN almoſt every thing relating to building, we may refer to the rules and practice of the antients for models and examples of improvement; but in reſpect to chimnies we have no ſuch reſource.

All that we find in Vitruvius, and other antient writers, on chimnies, is ſhort and trivial; and the rules for conſtructing them, full of obſcurity. Indeed, as they lived in warmer climates than ours, they had the leſs occaſion for them; and the uſe of ſtoves rendered chimnies an object of little attention. Some occaſional directions for the conſtruction of chimnies, have been publiſhed, by ſeveral modern authors, in treatiſes on buildings; but moſt of them are very erroneous, and none of them ſatisfactory, either to gentlemen or workmen.

Our neceſſity for chimnies in this climate is abſolute; nothing, therefore, more eſſentially claims our attention than their proper conſtruction and diſpoſition. The judicious architect and builder ought to adjuſt the ſize of the chimney, in due proportion to that of the room; having a reſpect to the diſtribution and ſituation of doors and windows, and a particular regard to external objects.

The ſeveral cauſes of defects in chimnies are numerous, but may be reduced to the three following principal heads.

Firſt, a bad and faulty conſtruction and execution of one or ſeveral parts of the chimney itſelf.

Secondly, ſome fault in the other parts of the houſe, reſpecting their poſition or proportion to the chimney; as for example, the poſition and ſituation of doors and windows, cloſeneſs and ſize of rooms, &c.

Thirdly, to external obſtruction, as higher buildings; greater elevation of ground, as hills; and the nature of the region alſo from what quarter the furious winds moſtly blow, &c.

Firſt, as to a bad and faulty conſtruction of one or more parts of a chimney.

A CHIMNEY is ſo agreeable an object that it attracts more than an ordinary ſhare of our attention, and if it is decorated with judgment and taſte, is an elegant ornament. Its principal parts are,

The HEARTH, floor, bottom, or pavement of a fire-place, on which the grate, ſtove, or dogs, are placed, for the reception of our fuel.

The CHIMNEY JAMBS, or ſides of a chimney, which are generally at right angles from the back, as at *g*, *f*, *fig*. 6. but are ſometimes circular, or elliptical, as *w*, *y*, *z*, *fig*. 8, or in an obtuſe angle, ſloping outward, as *o*, *p*, *q*, *r*, *fig*. 7, from the back.

The MANTLE PIECE, which is the lower part of the breaſt or front of a chimney, as *a*, *a*, *a*, *fig*. 4. Formerly it was a piece of timber that lay acroſs the jambs (and was then called the mantle-tree) and ſupported the breaſt-work; but by a late act of parliament, chimney breaſts are not to be ſupported by a wooden mantle-tree, or turning piece, but by an iron bar, or by a brick or ſtone arch.

The OPENING, Fire-place, or Mouth of the chimney, is the aperture, or vacancy, in which ſtands the ſtove or grate, as *a*, *b*, *c*, *d*, at B, in *fig.* 1, whoſe height is the ſpace between the hearth and the mantle-piece; the breadth, the diſtance between the jambs; the depth, from the front of the jambs to the back of the chimney, as at *g*, *f*, *fig.* 6.

The MOUTH of the FUNNEL, or Tube, is the contracted part, or gathering of the wings (or upper part of the jambs) and breaſt of the chimney, to the proper ſize of the funnel; or is the ſpace between the lower edge of the mantle-piece and funnel, as *d*, *l*, *m*, *e*, at A, in *fig.* 1.

The FUNNEL, &c. is a tube, conductor, or conveyance, through which the air and ſmoke aſcend and diſperſe in the upper region gions of the atmoſphere, as at *b*, *b*, *b*, *b*, *b*, *fig.* 1.

FLUES are ſmall winding tubes, or funnels, carried up into the main funnel from coppers, furnaces, ovens, or ſtoves, in large kitchen chimneys, as *i*, in A, *fig.* 1, or where there are one or two diviſions in the gathering of a large chimney.

SHAFTS of CHIMNIES are the extreme parts of the ſtone or brick work, round the funnels above the roof, which admit of being finiſhed in an ornamental taſte, according to the orders of architecture, as G H, *fig.* 1.

The errors in the conſtruction and execution of theſe parts of a chimney which occaſion ſmoke, are of the following nature.

The opening, or fire-place, being too large in its dimenſions for the apartment. For if the chimney piece is too high, the diſtance between the fire and the mantle-piece, permits the cold air to paſs above the fire, without being properly rarefied, as *b* in B, *fig.* 1. It is alſo very common for chimnies to be much wider than the grate, as at the ſtove repreſented in B, *fig.* 1, which equally admits great quantities of cold air to paſs at each ſide. Again, if the fire-place is too deep, the grate ſtanding far back, the air is not heated as it enters; and if the grate is brought forward, and a vacancy left at the back (as repreſented by the ſtove at B, in the ſame figure) the evil will not be remedied, unleſs the back of the ſtove is built up with brick-work, as is repreſented at *d*, in C, *fig*. 4; for the air will paſs under the ſtove, and aſcend behind it very little rarefied.

In all caſes of this ſort, where there is a quantity of cold air permitted to enter the chimney, without being properly heated and rarefied by the fire, the ſmoke is ſtifled, and checked at the firſt ſetting off, and miſſing its way returns into the room.

Therefore, the nearer the air is made to paſs the fire on all ſides, the more rarefied it will be; and the leſs vacancy there is in the chimney place, it will aſcend up the funnel with the greater rapidity. In ſuch caſes, it is found that a proper contraction of the chimney place cures the ſmoke, if there is no other obſtruction or cauſe interfering.

Secondly, ſmoke is alſo occaſioned by not contracting or gathering the wings and breaſt of the chimney in a proper manner.

When the aperture of the fire-place, above the under edge of the mantle-piece is carried up tapering ſlowly towards the next ſtory, as *a*, *b*, at A, *fig*. 3, or gathering narrower all the way to the top of the chimney, as *c*, *d*, at B, in *fig*. 3, the conſequence is, that a large quantity of cold air hangs lingering about. The chimney, being loaded with fuliginous vapours not duly rarefied, they hover round in eddies, and almoſt equiponderate with the reſt of the atmoſphere; whereby the aſcent of the ſmoke is ſo ſtagnated, that the leaſt guſt of wind drives it back into the room.

The only remedy for this evil is contraction in that part; the cheapeſt method to perform which is, by fixing a ſheet of milled iron on each ſide, within the mantle, as low as poſſible, ſlanting up towards the middle of the chimney; and this may be fixed by an ingenious workman, with ſuch neatneſs, as not to be perceived, and ſo as to regulate the draught of the chimney at pleaſure; as deſcribed in the explanation of *fig.* 3.

Some workmen, of late years, have run into an oppoſite extreme, by contracting the breaſt and wings of the chimney in ſuch a manner as to form the mouth of the funnel cloſe to the mantle piece, as repreſented in *fig.* 2, where the dotted lines at *a* below, ſhew the under edge of the mantle. But this is a greater evil than the laſt; for when the fire is firſt kindled, great quantities of vapour fly off, and the funnel being filled with cold, condenſed air, the vapour being expanded by the fire, and endeavouring to aſcend, is checked and ſtifled by the ſudden contraction at the mouth of the funnel; and is therefore forced into the room before it can overcome the reſiſtance.

The cure for this is diſagreeable. To cut away the ſtone or brick work, to give room for the expanſion of the air, as at the dotted lines *b*, *b*, in *fig.* 2, may be dangerous to the bond of the chimney, particularly if funnels interfere; and to lower the mantle may be inconvenient. If neither can be done with propriety, which muſt be referred to the judgment of the workmen, the only ready remedy is to have a blower, made of milled iron, or a plate of braſs, the whole width of the chimney, to come as low as the upper bar of the grate or ſtove, and to hang or hook to the chimney piece, as occaſion requires. This will not only carry off the ſmoke, but make the fire burn briſkly.

Thirdly, ſmoke is occaſioned by wrong conſtruction, and bad execution of the funnels or tubes of chimnies.

The faults in funnels, both in conſtruction and execution, are many. It is no leſs aſtoniſhing than true, that the principal cauſe of the ſmoking of chimnies in London, particularly, is owing to the careleſs, ſlovenly, and bungling execution of the funnels. I have ſeen them in capital new houſes, ſo choaked up in more places than one, that they could not be cleared till the brick work of the chimney had been cut away, and ſuch large quantities of brick-bats and rubbiſh taken out, that any one might juſtly ſuppoſe it done deſignedly; whereby the pargeting, or plaiſtering on the inſide of the funnel, if any there were, (for it is not uncommon with ſome gentlemen bricklayers to forget, or neglect it at times) is broke and deſtroyed, whence the inſide thereof muſt remain rough, ragged, and uneven, which greatly impedes the free aſcent of the air and ſmoke, and can never be mended.

It is often the caſe, that funnels are carried up narrower at one place than another, and with bulges, which greatly ſtagnate the air and ſmoke in their paſſage, making lodgements for large bodies of ſoot. This is often the cauſe of chimnies taking fire, renders the ſweeping of them very difficult, and is the occaſion of large lumps of ſoot falling into the fire, as the funnel *a*, *b*, *c*, *d*, *e*, *f*, *g*, *h*, at A, in *fig*. 3.

Another fault, often committed, through ſloth, ignorance, or careleſsneſs (it would be uncharitable to impute it to deſign) is, where funnels wind, bend, and turn, in their courſe.

If theſe deviations from a vertical direction are made ſudden and acute, they always obſtruct the free paſſage of the air and ſmoke, even if the bricks are cut true to the ſplay, which is ſeldom the caſe. I have often ſeen bricks laid whole, one back upon another (in turns or bends) like ſteps of ſtairs; and on the oppoſite ſide projecting ſquare over one another, as is repreſented by *b*, *c*, *d*, *e*, at A, *fig*. 3, which makes the air and vapour linger in the funnel, and never go off freely, and always occaſion ſmoke, and a long train of other bad conſequences.

Theſe defects are unpardonable, being occaſioned by nothing but mere negligence in the execution of the work. They are incurable, and will baffle all the troop of quack chimney doctors in their endeavours to make them perfectly clear of ſmoke. They may put their gloomy looking blowing ſtoves below, and their ugly, dangerous machines at the top of the chimnies; but all their patchwork will have no effect in theſe caſes. It is only picking the proprietors pockets to attempt a cure.

Theſe are ſome of the ſhameful, blundering, and incurable faults of a great number of our modern chimnies, in the moſt ſplendid and magnificent edifices.

If a funnel be made too narrow to receive the ſmoke with freedom, it will then naturally be forced into the room to find ſome other paſſage: this defect is very common, and the remedy troubleſome and difficult.—The moſt effectual cure, if the ſituation will admit, is to build a ſmall additional flue, and open a hole into it from the back of the chimney, near the level of the mantle-piece, ſlanting upwards in an eaſy direction; this ſupplemental flue muſt be carried to the top of the building to receive the ſurplus of the ſmoke, and will prove a certain cure.

But if the ſituation will not allow of this expedient, the fire-place may be contracted, both in breadth and height, if it can, with convenience, be admitted; a ſmaller grate or ſtove uſed, and the chimney heightened at the top: which will oblige the air to paſs cloſe over the fire, and carry up the ſmoke with greater rapidity; for the quicker the current, the leſs room it requires.

If that only cures in part, and the chimney ſmokes ſtill at times, a blower, or front plate of braſs, or milled iron, to put on and take off at pleaſure, as before deſcribed, will be of uſe.

But if none of the above preſcriptions will anſwer, the laſt remedy is, to fix a blowing ſtove in the fire place, which makes the air go through the fire, as in a furnace, and accelerates the aſcent both of the air and ſmoke with grear velocity.——Yet we can, by no means, recommend blowing ſtoves, of any kind, but as a dernier reſort; they conſume a prodigious quantity of fuel, and never warm the room properly, by being ſo confined and concealed; for while a perſon is ſcorched with the fire on one ſide, they are chilled and cold on the other. An open fire is a cheerful companion, and an agreeable object: but theſe ſtoves which conceal the fire, are not only diſagreeable, but dangerous, if great care is not taken of them. Should this laſt method fail, the chimney may be deemed incurable.

If a funnel is made very wide at bottom, and contracted very narrow at the top of the chimney, or nearly ſo, as is often the conſtruction with garret chimnies, a funnel built on this plan will certainly ſmoke; from the ſame cauſe as is aſſigned in the article of gathering the wings and breaſt of a chimney in a gradual tapering direction from the mantle-piece to the top of the funnel. See page 18 and 19, and *c*, *d*, in A, *fig*. 3.

To cure this defect, the ſame method may be uſed below at the mantle as is there preſcribed; by fixing a ſheet of milled iron on each ſide, and raiſing and contracting the top of the funnel, if it can be done without injuring the adjoining funnels.

Having explained ſeveral of the principal cauſes of ſmoke, in the conſtruction of chimnies, with the remedy where they are curable; we ſhall only add two or three more obſervations, which, though they may be eſteemed trifling, may yet be found uſeful.

When part of the top of a chimney is broken down, it cauſes the chimney to ſmoke, when the wind blows in that direction. Therefore, mending the top, and keeping the upper edge level and even, cures it.

It ſometimes happens that an apartment is filled with ſmoke when a fire is kindled in an adjoining chimney, and no fire in the incommoded room ; although it does not ſmoke when it has a fire burning in its own grate.

This may ariſe from two cauſes ; firſt, by the wind driving the ſmoke down the funnel of the adjoining room, along with the cold air that may be forced down by ſome accidental guſt, or diverſion of wind in the houſe ; to prevent which, raiſe a circular partition between the funnels at top, about three inches, which will prevent it ; or by coping the chimney with ſtone, as afterwards directed.

Sometimes it happens from holes being in the partition that divides the two funnels ; for as ſmoke is of itſelf a denſe body, buoyed up by the rarefied air only, ſo when it enters the cold tube it naturally deſcends, and comes down into the room.

Some perſons will undertake to cure this, as well as perform other impoſſibilities, and run gentlemen to an immenſe expence, to no purpoſe. There is no perfect cure for it but pulling down the chimney to the part where the holes are, and rebuilding it in a ſound manner.— The only relief ſhort of pulling it down, is to make uſe of a ſmoke board, fitted exactly into the aperture of the chimney, even with the under edge of the mantle; which will, in part, ſtop the ſmoke from entering the room. Therefore great care ſhould be taken that the partitions between funnels, be built ſound and ſolid, and well plaiſtered or pargeted, on both ſides, to prevent this evil.

If a ſtack of chimnies in a gable end, or flank wall, is expoſed to the wind, great care ought to be taken that there be no little holes or cavities, through the wall into any of the funnels; if there are, when the wind blows in that part, the chimney is ſure to ſmoke. The wall ſhould, therefore, be pointed down with great care, and good mortar uſed.

It is known that large ſums of money have been fruitleſsly waſted in experiments on chimnies ſo ſituated, before the real cauſe was diſcovered ; but when the wall was pointed down, with care and good mortar, and the machinery taken off from the top of the funnels, they did not ſmoke in the leaſt. We have known more inſtances of this than one.

PROPORTIONS *of the ſeveral Parts of a* CHIMNEY, *according to the Size of the* APARTMENT.

FROM the ſeveral principles already advanced, it is demonſtrably clear, that the dimenſions of every chimney, and parts thereto belonging, ſhould be proportioned to the ſize of the room ; for every room contains a portion of air equal to its capacity, which requires a proportionable degree of fire to render it comfortably warm.

For obtaining a clearer idea of the application of theſe principles to the different parts of chimnies, ſeveral mathematical and philoſophical inferences may be deduced, and comparative calculations formed. From experiments made with the air-pump, barometer, and hydroſtatical inſtruments, by Sir Iſaac Newton, Mr. Boyle, and other eminent philoſophers, we have diligently acquired ſufficient data to form the following table with the greateſt accuracy and preciſion. And as the rules for ſuiting the dimenſions of the different parts of a chimney to the ſize of the apartment, are ſo plain and eaſy, and never before attempted, we hope they will be acceptable to the public.

The following table of dimenſions is adapted to all rooms except kitchens, whoſe chimnies need not be confined to the nice proportions required in dining rooms, parlours, bed charmbers, dreſſing rooms, cloſets, halls, &c. Kitchen chimnies are neceſſarily of a larger ſize, for the convenience of the various operations of cookery ; and if the range is made ſuitable to the opening of the chimney, and properly ſet, the gathering of the breaſt and wings, and the funnel be properly executed, as hereafter explained, there will be no danger of ſmoke. The fire being ſufficiently large, rarefies the air accordingly, and the ſteams flying out of pots and kettles aſſiſt the aſcent of the air and ſmoke, and carry them off with great velocity.

EXPLANATION of the TABLE.

THE firſt column is the ſquare of rooms from ſix feet to thirty-ſix feet ſquare: to find which, add the length and breadth of the room together, and take half that ſum for the mean proportion.

The ſecond column is $\frac{2}{3}$ of the firſt column, and gives the proper ſuperficial contents of the opening, or mouth of the chimney.

The third, fourth, and fifth double columns, are three differently calculated proportions of the breadth and heights of chimney pieces, which multiplied together, the contents will be the ſame, or near to the ſecond column, or two thirds of the ſquare of the room. All theſe dimenſions are calculated to be the ſize of the chimney piece, when compleatly finiſhed; therefore, covenings, ſlips, and noſings, &c (if any) are to be allowed for in the breadth of the chimney, in carrying up the work.

The ſixth column is the depth of the chimney from the front of the jambs to the back.

It follows nearly in a direct ratio of proportion in matter, that the $\frac{1}{4}$ of the ſquare of the opening gives the depth of the chimney; but as there is no rule without exception, and in this particular experience has proved that no chimney ſhould be ſhallower than 1 ft. 3 in. or deeper than 2 feet, I have therefore calculated and divided this column into four parts or proportions, which will be more convenient to workmen, and anſwer the purpoſe better than to have a proportion to every ſize.

The ſeventh column is the dimenſion of the ſquare of the funnel: the rule for finding this is to take the $\frac{1}{6}$ for the ſquare of the funnel; but it falls under the ſame predicament as the laſt; for experience has proved in many inſtances, that no funnel, if properly executed, ought to be leſs than 10 inches, or more than 16 inches, being a tube ſufficient to carry off any body of ſmoke ariſing from any common fire; and to be made according to the ſize of the room as marked.

The eighth column gives the diameter of a circular funnel, which will hereafter be more fully explained. N. B. Obſerve that theſe are the dimenſions of the flue when finiſhed; ſo the thickneſs of the pargetting on both ſides muſt be allowed for in carrying up the work.

Theſe calculations are made for rooms from 10 to 12 feet high, clear from the floor to the ceiling; if more, for every foot the ceiling is higher, add one inch to the breadth of the opening to the chimney, one half inch to the height; one quarter of an inch to the depth, and about one eighth, or a little more, to the ſquare, or diameter of the funnel. And if the ceilings are lower than ten feet, reduce the parts by the ſame proportion.

With regard to the height of the chimney-pieces, I would recommend none in dining-rooms, parlours, &c. wider than five feet, or higher than four feet, even in the largeſt apartments. For which reaſon I would have carried the table no farther than a room of thirty feet ſquare, (and that, indeed, is a room too large for one fire place;) but as particular reaſons may ſometimes happen for their being larger, the table is carried to thirty-ſix feet ſquare.

A large apartment with only one fire-place is neither comfortable nor agreeable : it can never be regularly warmed in all parts, nor decorated with deſirable ſymmetry and elegance. Whereas two ſmall fire-places will diſtribute an uniform degree of warmth thro' the whole.

To find the dimenſions of chimney pieces where two fire-places are required in a room, according to its ſize. Suppoſe a room to be fifty feet long, and thirty feet wide; added together is eighty, the fourth part of which is twenty feet, which is half the ſquare of the room. Now look for 20 in the firſt column, and oppoſite, in the third, fourth, and fifth columns, you find the proportions of the openings required for two chimnies of a room of that ſize ; and by the ſame method you find the proportions adapted for any other room.

These dimenſions may be ſomewhat enlarged,

A TABLE

of the

Firſt Column.
If the ſquare of the room be 6 feet
7 0
8 0
9 0
10 0
11 0
12 0
13 0
14 0
15 0
16 0
17 0
18 0
19 0
20 0
21 0
22 0
23 0
24 0
25 0
26 0
27 0
28 0
29 0
30 0
31 0
32 0
33 0
34 0
35 0
36 0

TABLE *of the Proportion of the ſeveral Parts of a* CHIMNEY *according to the Magnitude of the Apartment. Calculated on Geometrical Principles, and confirmed by Experience.*

irſt umn.	Second Ditto.	Third Column.		Fourth Column.		Fifth Column.		Sixth Column.	Seventh Column.	Eighth Column.
the are of room 6 feet	The ⅔ will be	Breadth of the Chimney.	Height of the Chimney.	Breadth of the Chimney.	Height of the Chimney.	Breadth of the Chimney.	Height of the Chimney.	Depth of the Chimney.	Square of the Funnel.	Diameter if circular.
	4 0	1 3	3 2	1 4	3 0	1 6	2 9	1 3	0 10	0 11
7 0	4 8	1 5	3 3½	1 6	3 1½	1 8	2 10			
8 0	5 4	1 8	3 2½	1 10	2 11	1 11¼	2 9		0 11	1 0
9 0	6 0	1 10	3 3¼	2 0	3 0	2 1½	2 10	1 6		
0 0	6 8	2 0	3 4	2 2	3 1	2 3½	2 11			
1 0	7 4	2 2	3 5	2 4	3 2	2 5½	3 0			
2 0	8 0	2 4	3 5½	2 6	3 2¾	2 7¼	3 1		1 0	1 1
3 0	8 8	2 6	3 6	2 7¾	3 1¼	2 9¼	3 1½			
4 0	9 4	2 8	3 6½	2 9¾	3 4	2 11½	3 2			
5 0	10 0	2 10	3 6¾	2 11¾	3 4½	3 1½	3 2½			
6 0	10 8	3 0	3 7	3 1½	3 5	3 3½	3 3	1 10	1 1	1 2
7 0	11 4	3 1¾	3 7¼	3 3½	3 5½	3 5½	3 3½			
8 0	12 0	3 3½	3 7¾	3 5¼	3 6	3 7¼	3 4			
9 0	12 8	3 5	3 8½	3 7	3 6½	3 9	3 4½			
0 0	13 4	3 6¾	3 9	3 8¾	3 7	3 11	3 5		1 2	1 2½
1 0	14 0	3 8¾	3 9½	3 10½	3 7½	4 0¾	3 5½			
2 0	14 8	3 10	3 10	4 0	3 8	4 2½	3 6			
3 0	15 4	3 11¾	3 10½	4 1¾	3 8½	4 4	3 6½			
4 0	16 0	4 1¼	3 11	4 3¼	3 9	4 5½	3 7			
5 0	16 8	4 2¾	3 11½	4 5	3 9½	4 7¼	3 7½	2 0	1 3	1 3½
6 0	17 4	4 4	4 0	4 6½	3 10	4 8¾	3 8			
7 0	18 0	4 5½	4 0½	4 8	3 10½	4 10¼	3 8½			
8 0	18 8	4 7	4 1	4 9¼	3 11	4 11¾	3 9			
9 0	19 4	4 8¼	4 1½	4 10¾	3 11½	5 1¼	3 9½			
30 0	20 0	4 9¾	4 2	5 0	4 0	5 2¾	3 10		1 4	1 4
31 0	20 8	4 11	4 2½	5 1½	4 0½	5 4	3 10½			
32 0	21 4	5 0¼	4 3	5 2¾	4 1	5 5¼	3 11			
33 0	22 0	5 1½	4 3½	5 4	4 1½	5 6¾	3 11½			
34 0	22 8	5 2¾	4 4	5 5¼	4 2	5 8	4 0			
35 0	23 4	5 4	4 4½	5 6½	4 2½	5 9¼	4 0½			
36 0	24 0	5 5¼	4 5	5 7¾	4 3	5 10½	4 1			

larged, if thought neceſſary, but muſt be done with prudence.

The third, fourth, and fifth columns are three differently calculated proportions of the heights and breadth of chimney pieces for rooms of any ſize, whereby gentlemen or ſurveyors may chooſe which they think beſt adopted to the apartment, in reſpect to the height of the mantle. If a ſmall houſe for working people, the higher the mantle the more convenient for them, but proportion may be more ſtrictly adhered to in genteel houſes.

On the CONSTRUCTION *and* EXECUTION *of* CHIMNIES.

Firſt, Of the Fire-Place, or Opening.

HAVING finiſhed the table of proportions for the ſeveral parts of a chimney, we ſhall now enter on the moſt important ſubject, of planning, erecting, and executing them in a proper manner and form; which, if truly obſerved, and followed by the workmen, gentlemen may be aſſured of being freed from the worſt of all plagues, that of ſmoke in their houſes.

The firſt particular is, that of the fire-place, or opening, as the foundation work. We have already mentioned the evil conſequence attending the fire-place being too large for the grate, either as to height, breadth, or depth, viz. preventing the air entering it from the chamber, from being well rarefied, which will alſo be the caſe where the jambs and back are carried up ſquare, as *d*, *g*, *f*, *fig*. 6, and a ſmall grate, or ſtove fixed in it, as *h*, in B, *fig*. 1.

The moſt perfect and complete way to carry up that part of the chimney, and what we would recommend to every gentleman, is to have the jambs and back of the chimney at the fire place to form a ſegment of a circle, or an ellipſis, as in the plan at *w*, *y*, *z*, in *fig*. 8, whereby the corners being filled up, prevent any cold air lodging, or hovering about there, to obſtruct the aſcent of the ſmoke.

We could wiſh to reply to ſuch objections as may be made to any uſeful improvement recommended, and we well know that ſeveral workmen will object to this ſimple improvement, by repreſenting the extra expence of carrying up the brick work, and the extra expence of circular covings, particularly if they are marble. Circular marble covings we know to be expenſive; but Portland ſtone is not ſo dear; or if the inſides of chimnies are ſet with Dutch, or galley tiles, the expence is no object; and even marble, with Bath ſtoves, will not come very high. But this objection will be obviated by having plain or flat jambs to ſlope inward,

with

with an obtuſe angle from the wall, or back of the chimney, as *o*, *p*, *q*, *r*, in *fig*. 7, (which will be no more expence of any materials than the ſquare chimney place, *fig*. 6) and will in part anſwer the purpoſe intended, though not ſo completely, as if circular or elliptical.

Secondly, Of contracting and gathering the Breaſt and Wings of a CHIMNEY *from the under Edge of the Mantle to the Mouth of the Funnel.*

THIS is a nice article, and ought to be executed in a maſterly manner; on this depends the proper draught and free circulation of the air and vapour at the firſt out ſet: we have already remarked the two extremes in common practice, and the evils attending them.

Firſt, where the aperture above the mantle edge is carried up ſloping ſlowly for a conſiderable height, as repreſented in the two funnels in *fig*. 3. And ſecondly, where the wings of the chimney are ſo ſuddenly contracted as to form the mouth of the funnel, almoſt at the under edge of the mantle piece, as repreſented at *a*, in *fig.* 2. Both theſe extremes are to be avoided, as they are attended with the conſequences before mentioned, and a chimney ſo conſtructed can never be clear of ſmoke.

The height of the gatherings, or arching, to chimney wings and breaſts, ought to bear a proportion to the width of the opening, or fire-place, which may be fixed at, or nearly to the $\frac{1}{3}$ of the width: however, two or three inches under or over will not ſignify, as circumſtances may happen, or ſituations require.———In the execution the following rules are to be cloſely followed, as ſet forth in the fire-places in A, B, C, D, and E, *fig.* 1, viz. that the gathering of the wings on each ſide be ſloping, or bevil, equally alike, ſo that the mouth of the funnel may be vertical over the middle of the fire, as repreſented by the dotted lines in the middle of the fire-places to the center funnels in *fig.* 1. For the rarefied air, with the ſmoke or vapour always riſe from the burning fuel in a perpendicular direction, and a ſpiral form; and by the funnel mouth being right perpendicular, they gather together in a regular body into the funnel. Secondly, obſerve that the brick or ſtone work be cut true and ſmooth to the ſplay, or bevil of the arch, and not left ragged, as repreſented at *a*, *b*, in A, *fig*. 3.——The roughneſs will retard the aſcent of the ſmoke, and be places of lodgment, and receptacles for the ſoot, whereby that part of the chimney will never be clean, even if ſwept with the greateſt care.

The next thing to be conſidered in this article, is the form, or gathering of the breaſt of the chimney. In this it is to be obſerved, that the thinner the under edge of the breaſt of the chimney, or mantle, is, the greater is the advantage, as the grate may thus be brought forward towards the room. If the chimney is built with bricks, the arch may be turned upon a thick bar of iron, about two inches wide, and ſlant bevil upwards, as at *a*, *b*, in A, and *a*, *b*, in C, in the profile, *fig*. 4. regular to the funnel mouth, with the wings. If the chimney is built with ſtone work, the arch may be made to taper from the under edge of the mantle, in a very ſmall thickneſs.

The main point, in this particular, is the manner of gathering, arching, or contracting the wings and breaſt of the chimney together. If they are contracted in a ſquare form, there will be unneceſſary ſpace in the corners for the cold air to harbour in, and obſtruct the draught, as before obſerved.

The proper method is as at *a, b, c, d,* in *fig.* 5, which repreſents the ſetting off and beginning the arch, for the contraction, from the corners, (as ſhewed by the dotted lines *e, f, g, h, fig.* 5,) of the wings and breaſt in a circular form; beginning immediately at the under edge of the mantle-piece, as at *o, b,* in C, *fig.* 1, gathering regular to the mouth the circular funnel at N, N, in ditto.

At N, in *fig.* 5, is the repreſentation of the mouth of a circular funnel, which *e, f, g, h,* is to be contracted to in a circular regular manner, at eighteen inches high from the under edge of the mantle piece, at the dotted lines, *o, n,* in C, *fig.* 1. By this method of circular contraction, all the vacant room in the corners will be filled up, and the jambs and back of the chimney below (as before recommended) being carried up alſo circular, the chimney will ſo far be properly and perfectly conſtructed. And the gathering of the breaſt, wings, and back of the chimney being well and ſmoothly plaiſtered, with good and ſtrong mortar, made of hot lime and ſea-coal aſhes, will make it a maſterly and compleat performance.

Thirdly, On the proper Method of executing Funnels of Chimnies.

THE funnel is the principal article belonging to a chimney, which to have perfect and compleat, the funnel muſt be carried up with the beſt of materials, and executed in a maſterly manner, with the greateſt accuracy and circumſpection, as regular, even, and ſmooth as poſſible. It ſhould be of an equal degree of width from the bottom to the top, as a very ſmall fault in a funnel will ruin the whole chimney; and a fault in the funnel is of that diſagreeable nature that it cannot be remedied without pulling down the chimney entirely to the faulty part.

Having explained the proper method to conſtruct and execute the fire-place, and for the contracting of the wings of the chimney to the mouth of the funnel, and ſhewn that the paſſage of the air and vapour into the funnel ought to be gradual and eaſy; we go on to obſerve, from the ſame principle, that the mouth of the funnel may properly be a little wider at the beginning, and tapering ſlowly to its proper ſize, to make the aſcent of the ſmoke free and clear from any ſudden check, at the firſt outſet, as is repreſented in all the funnels to the fire-places in *fig.* 1, where the funnels are about two inches wider for about two or three feet up, when the reſt of the funnel to the top is of as equal a gauge as poſſible, in every part. All neceſſary windings and bends ſhould turn in an eaſy circular form, as is repreſented in the funnels, *fig.* 1, where ſharp and acute windings are avoided: crooked directions in a funnel will not ſenſib'y impede the free aſcent of the ſmoke, if they are of a circular and eaſy ſweep.

As the rarefied air and ſmoke by its nature aſcends vertically, if the chimney will allow it, the higher the funnel can be carried perpendicularly before the inclination, or bending takes place the better; for by the ſmoke aſcending at firſt in its natural direction, the current acquires ſtrength to carry it thro' the inclined peſſage, as is repreſented by the dotted lines acroſs, in the parlour, dining-room, and garret chimnies, in *fig.* 1. The parlour chimney funnel going 1 f. 8 in. perpendicular, the dining-room 2 f. and the garret 1 f. as marked in the margin; then the direction muſt be made to turn round the upper chimney, with as ſmooth and eaſy a courſe as poſſible; as the kitchen chimney funnel at A, and the two pair of ſtairs funnel at D, *fig.* 1.

It is a great advantage for all funnels to have a winding direction, as near to the top as poſſible; for, as ſtrong, ſudden, and accidental guſts of wind will ſometimes enter, and beat into the top of a funnel, the firſt turning, or bend, will break the force of the wind, whereby the internal air and ſmoke will ſoon repel it, and proceed in its former courſe. But if the funnel is ſtraight, and it meets with no interruption, it will ſtop the paſſage of the ſmoke for a while, and, of courſe, force what riſes from the fire immediately into the chamber. It is to be obſerved that the further the wind gets down the funnel, the greater ſtrength it will require to be repelled, therefore the nearer to the top, the bend or winding is, the better, as *fig*. 1.

Alſo if there is little wind, with a very heavy ſhower of hail, ſnow, or rain, falling perpendicular in great drops, the firſt bend, or turning will, in part, ſtop their progreſs; if rain or ſnow, unleſs a very heavy ſhower indeed, and if hail ſtones they will ſlide gently down the ſides of the funnel, without diſturbing the aſcent of the air and ſmoke; but if the funnel is perpendicular all the way down, the great drops of hail, ſnow, and rain will fall freely to the bottom, repelling the ſmoke along with it into the room; and if the funnel is foul, will beat down great quantities of ſoot into the fire. Theſe reaſons recommend a bend in ſome part of the funnel as abſolutely neceſſary; and a more perfect, convenient, and eaſy method for ſuch a direction can hardly be contrived, than as repreſented from the garret ceiling to the top of the chimney, *fig*. 4. where the funnels gather in a natural declined direction, and riſe afterwards in a perfect regular ſtate, as at *b, b, b, b, b*.

Garret chimnies are more liable to ſmoke than any other in the houſe, owing to the ſhortneſs of the funnel: for when the rarefied air and ſmoke has made its way up a high funnel, it forms a ſtrong column, and to repel it requires a proportionably great force, which in a garret chimney cannot be obtained; therefore what cannot be had from nature, muſt be aimed at by art. The fault in moſt garret chimnies is being carried up in a ſtrait direction from bottom to top in a ſlovenly manner, and with funnels as large as any in the houſe; whereby the little internal rarefied air has the whole immediate preſſure of the atmoſphere to reſiſt, which, in general, is too powerful for it. But a garret chimney carried up and executed in a proper manner, with due proportion in every part, according to the ſize of the room, and the funnel in an eaſy crooked direction (as *b, c, d, e,* at E, *fig.* 1) will draw and be as clear from ſmoke as any other.

Be ſure to work the funnel on the inſide ſtraight up at the top to the very edge, without the leaſt variation, and to finiſh in the following manner. We recommend the upper ſhafts of chimnies, in genteel houſes, to be of ſtone work, or at leaſt the coping, as at *a*, *a*, in the ſhaft G, H, in *fig.* 1; and to prevent guſts of wind from blowing down, or the ſmoke of one funnel beating down another, let the external part of the wall round all the funnels be ſplayed, or champered, beviled downwards on the out edge, as *a*, *a*, at the top of the ſhaft, *fig.* 1. For by this means the horizontal direction of the wind will be broke, and driven in a riſing direction over the funnel; and the ſmoke aſcending up will not be affected ſo much by it, even if it blows ſtrong. The tops of the partition walls, between the funnels, are to be hollowed, or grooved, and are to be finiſhed ſharp, with the edge of the inſide of the funnel, as *c*, *c*, *c*, *c*, at ditto: for there will always be a current of air paſſing through theſe grooves, which will divert the external air, and keep the top of the adjoining funnels clear from the ſmoke of the others, and alſo from the effects of the wind, blow from what part it will. This plan properly executed with ſtone, (for they cannot be done ſo with bricks) will prevent ſeveral bad conſequences attending chimnies, and is the compleateſt way of finiſhing tops.

Chimney ſhafts, whether of ſtone or brick, ought to be executed with the very beſt materials; particularly the mortar; for being wholly expoſed to the driving winds and rains, they are ſooner affected, and decay before any other part of the building; and when the chimney is in a ruinous ſtate, it is ſure to ſmoke.

Mortar for the ſhafts of chimnies ſhould be made with the ſharpeſt and cleaneſt ſand that can be got. The drift ſand of rivers, where it can be had, is the beſt for that purpoſe; but we would recommend ſea coal aſhes, free from wood, aſhes, dirt, or any other mixture, well incorporated, beat up, and worked, in the proportion of two parts of hot, or unſlacked lime, to one of ſand or aſhes.

The next thing to be conſidered is the form of the funnel. It is the general and univerſal cuſtom to make the funnel in a ſquare or oblong form; which, on many accounts, is very improper. The corners of a ſquare funnel, if ever ſo carefully pargetted and cleaned, contain a quantity of cold air; for the rarefied air, in its courſe up the funnel, never enters into them, as it always aſcends in a circular form; therefore being ſquare does not add to the width of the funnel, which, in ſtrict truth, is only the inſcribed circle. The air in the corners all the way up forming ſmall eddies, are the occaſion of the ſoot adhering and ſticking there, which by accumulating, forms into large knobs, and greatly retards the aſcent of the ſmoke. Theſe lumps occaſionally detached, by frequently falling into the room, are very dangerous, by catching fire, and it is almoſt beyond the art of man to ſweep them perfectly clean; on which account all funnels are beſt of a circular form, as *s*, *s*, in *fig*. 7.

The advantages attending a circular funnel are ſo obvious, as ſcarcely to need illuſtration. It will prevent all the evils and inconveniences before mentioned, if properly executed. The air will aſcend with the greateſt eaſe and freedom, the ſoot will not adhere to the ſides, nor will there be any vacuities ſor the cold air to hover about in, and it will be ſwept with the greateſt eaſe. This is an object well worthy the ſerious attention and conſideration of every gentleman concerned in building for his own accommodation.

The next article under this head is the pargetting, or plaiſtering the inſide ſurface of the funnel, which is a very eſſential point; for if the inſide of the funnel is not very ſmooth, the ſmoke will, leſs or more be retarded: and where it is rough and ragged, the ſoot will adhere and ſtick to theſe parts, and there accumulate. The regular ſmoothneſs of the inſide of the funnel greatly promotes and facilitates the aſcent of the rarefied air and vapour, and lets them paſs with eaſe and freedom to the top.

We ſhall not dwell on the inattention and neglect that has been hitherto ſhewn to this material and important article, nor the ſlovenly and careleſs manner in which it has heretoſore been executed by workmen. It behoves gentlemen to be particularly careful that this precaution is not omitted. Workmen ſhould have their pargetting, or plaiſtering, ready at hand, properly prepared with good materials, and lay it on always at a convenient height, that can eaſily be reached as they advance, and work it as ſmooth and even as poſſible. In the operation they ſhould be very attentive to prevent any looſe mortar falling down the funnel, from their trowel, (which may eaſily be prevented by having a ſmall piece of board underneath) as it will otherwiſe drop upon the bended part of the funnel, harden into lumps, contribute to choak the paſſage, and be attended with diſagreeable conſequences.

Pargetting mortar, which is uſed for the inſide of chimney funnels in London, ought to be made with care, in the following manner and proportion. To any quantity of the beſt and ſtrongeſt lime, ſifted fine, add one fourth part of freſh horſe-dung, clear from dirt and ſtraw; let them be well beat, and incorporated together, and uſed freſh made.

But we would recommend the following compoſition, as much preferable and more durable, if properly made, viz. to two buſhels of good ſtone lime, add one buſhel of fine

drift

drift gritty ſand, and a like quantity of ſea coal aſhes, or brick duſt: ſkreen them fine, beat, and incorporate them together, for the firſt coat, and when well ſet, put on the following for the ſecond, or finiſhing coat.

Take fine white plaiſter (commonly called plaiſter of Paris) mixed with ſtale ſmall beer, and work it well in a trough, or tub, to a due conſiſtence: then lay on a fine thin coat of it upon the other, carefully worked in, and as ſmooth and even as poſſible. In a ſhort time it will aſſume the hardneſs of ſtone, and a poliſh little inferior to marble. A funnel thus executed and finiſhed, can never be the cauſe of ſmoke, and if the expence is a trifle more, with a gentleman of fortune, who deſires a well finiſhed habitation, it can be no object.

The fixing or ſetting of STOVES, *or* GRATES, *in a* CHIMNEY.

THERE is as much neceſſity to have the grate, or ſtove, proportioned to the fire-place, as there is in the proportion of the fire-place to the room. If a ſmall ſtove is put into a large fire-place, and a fire made in it, it is ſure to ſmoke: for if a grate is too narrow, or too low, as the ſmall ſtove *b*, in B, *fig.* 1, is for the fire-place, and the fire-place too deep for it, as is repreſented at *b*, the profile of the ſtove, in B, *fig.* 4. great quantities of cold air are admitted to paſs above, at each end, and behind the ſtove, which the fire is unable to heat; whereby the current through the chimney cannot be effected. In any, or all of theſe caſes, the ſmoke, inſtead of being forced up the chimney, is ſtifled and checked; the equilibrium with the external air not being maintained in the funnel, the ſmoke muſt, of conſequence, deſcend into the room.

It is of the greateſt advantage to have the grate to come as forward as poſſible toward the room, whereby it is in every part more regularly warmed, and the intention of making the fire is attained. Where the fire is ſituated far back in a chimney place, it never warms the room thoroughly, for there is very little benefit received from it, except in the front; great part of the heat being confined by the jambs, or ſides of the chimney. It always hath a gloomy and diſagreeable appearance, and disfigures the whole apartment, however elgantly finiſhed and furniſhed in every other reſpect.

All ſtoves and grates ſhould be ſo fixed as not to admit of any air to paſs either over, behind, or at the ſides of the fire, without being rarefied. Therefore the rule to be obſerved is this; let the under edge of the mantle piece be as repreſented at *a*, *b*, in A, and *a*, *b*, in C, *fig*. 4, ſloping upwards on the inſide, then let the front of the grate, or ſtove, be fixed right perpendicular under the inner edge of the mantle, as the profile of the kitchen grate *c*, in A, and the profile of the Bath ſtove *c*, in B, in *fig*. 4. The dotted line ſhows the perpendicular. Now if the mantle was thick, as repreſented at *a*, in B, *fig*. 4, and the grate as far out, as in A, or C, to be within the inner lip of the mantle, it would interrupt the ſmoke in its aſcent, and throw it out into the room. This proves the utility of having the under edge of the mantle as thin as poſſible, in order to bring the grate forward into the apartment. To ſecure the back, and prevent any vacancy for the air going up behind, let the back of the ſtove or grate be built up with brick work, as *d*, in A, and *d*, in B, *fig.* 4, allowing no more room than is there repreſented; and in order to throw the heat more powerfully outwards into the room, let the brick work at the back of the fire-place be carried up ſloping regular as high as the gathering of the breaſt and wings of the chimney, above the grate, or ſtove, as *e*, *e*, in ditto: as the air preſſes in, out of the room, into the fire-place, the flame will act with the greater force, and reflect more heat into the room.

The rule for the height and width is to have all ranges, grates, and ſtoves full one half the height of a proper chimney-piece, as is repreſented in the ſection of the kitchen range *h*, in A, and the Bath ſtove, *h*, in C, *fig.* 1. the upper bar of the range is 2 ft. 4 in. high, and 6 in. on each ſide from the jambs, and the back of the range on a circular plan, as *w, y, z, fig* 8.

The Bath ſtove *b*, in the dining-room C, is 1 ft. 10 in. high, which is little more than half of the height of the chimney-piece; the under edge of the mantle-piece and back of the chimney upon the ſame conſtruction as above mentioned, and repreſented in C, at *d*.

Ranges and ſtoves thus fixed in a proper conſtructed chimney place, oblige all the air that enters into the chimney out of the room to paſs immediately over the fire, and to become properly heated and rarefied.——The back, the contraction of the wings and breaſt of the chimney, and the funnel being all properly conſtructed and executed, as before directed; the chimney, in regard to conſtruction, will anſwer every deſired purpoſe, and the ſmoke be carried off clear and free from every room in the houſe, to the comfort and ſatisfaction of the owner and poſſeſſor.

Of SMOKY APARTMENTS *ariſing from a wrong Poſition and Diſtribution of Doors and Windows, the Cloſeneſs and Smallneſs of Rooms, &c. Unconnected with the Conſtruction of the Chimnies; being the ſecond general Cauſe, ſtated Page* 13.

SMOKE is often occaſioned by an injudicious poſition of doors and windows, with reſpect to the ſituation of the chimney. For the ſmoke is forced into, and carried up the funnel by a continual and ſucceſſive preſſure of the air entering at the fire-place, which being there rarefied, ruſhes upwards, and carries the vapour with it into the outmoſt atmoſphere. But if the air is diverted from the chimney by any other cauſe, the ſmoke will, of courſe, be carried away with it into the room: ſo that if doors and windows are ſituated in ſuch directions as to produce currents of air, when the wind blows in particular quarters, they will be ſure to occaſion ſmoke. Add to this, that any cauſe whatever which tends to determine a current of air, from the under part of the fire, will as aſſuredly be the cauſe of producing ſmoke in the apartment.

From hence it is very eaſily to be conceived how the poſition of doors and windows may occaſion ſmoke, eſpecially in ſituations that are expoſed to violent and rapid currents of winds in particular directions.

To prevent theſe evils the following obſervations ought to be attended to, as it is a matter of more conſequence than is generally imagined.

Firſt, that all doors and windows be fitted and hung as exact and cloſe as poſſible, to prevent their admitting any great quantity of air; and that all front or outer doors, be made to open inwards, into a cloſe landing place, or lobby, that has no immediate communication with the ſtair-caſe, or any paſſage, but thro' doors occaſionally opening into each. Alſo that room doors open back towards the fire, as that will prevent the air being drawn from the chimney.

If poſſible avoid having any more principal front doors than one. Let it be hung on ſuch a principle as to paſs cloſe upon the threſhold when ſhut, to prevent the driving winds from beating in the rain at the bottom, which will be the caſe if not taken care of, and where it happens is very diſagreeable. All doors that have any communication with that in the front, ought to be ſo conſtructed as to ſhut cloſely of themſelves, to prevent the diſagreeable conſequences of accidental careleſſneſs.

But if there is more than one outer door, let there be no direct communication between them. I have ſeen a capital houſe ſo ſituated, filled with ſmoke all over, when the wind blew in certain directions.

Secondly, never admit of windows being placed oppoſite to each other on both ſides of the room, or doors in oppoſite directions to windows; for in ſuch caſes, they will always occaſion a current of air, that will more or leſs diſturb that tending toward the fire-place. Therefore avoid as much as poſſible having a free paſſage from one ſide of the houſe to the other, or having doors opening from one room directly into another, where windows are facing on each ſide of the houſe. For if doors and windows are ever ſo neatly fitted, they will admit ſome air, particularly if the wind blows high in the right direction, and will cauſe ſmoke to return from the chimney.

It is neceſſary here to obſerve that if the doors in the partition tranſmit as much or more air than the windows in the front, a current of air will flow from all parts of the room, and therefore will have a tendency to occaſion ſmoke. But, on the other hand, if more air comes in at the front windows than can get out at the door or doors in the partition on the oppoſite ſide of the room, in ſuch a caſe there will be no current, but the ſuperfluous air will be forced up the chimney, and carry the ſmoke clear off with it: hence it follows, that a room ſo ſituated, is ſometimes cured of the ſmoke by ſhutting up the door, or by rectifying its defects.

Now to ſtate a few caſes. If the windows and doors are open on both ſides of a room, the ſtrong current of air paſſing through will draw the vapour from the chimney, and will be a ſure cauſe of ſmoke. Again, if the windows upon which the wind blows are ſhut or cloſed up, and thoſe on the oppoſite ſide opened, nearly the ſame effect as above would be the caſe. But if the windows upon which the wind blows are opened, and thoſe on the oppoſite ſide ſhut cloſe up, the chamber will be intirely clear of ſmoke. For the admitted air having no other vent, muſt directly aſcend through the chimney; and this proves the neceſſity of having doors and windows made and hung in the moſt perfect and maſterly manner.

Hence the following inference is deducible, viz. that the doors and windows in a room ſhould be ſo diſpoſed as not to admit a ſtrait, or free paſſage, for the air to form a current from the fire-place.

More examples might be given, but the above varieties will enable the reader to form ſufficient idea of the manner that doors and windows ought to be diſtributed in a room.

Thirdly, if the plan of the houſe admits, have as many of the chimnies in the internal partition wall as poſſible; but if there are no brick partition walls, then always endeavour to place them in that ſide of the houſe that is leaſt expoſed to the wind; and the windows in that ſide that the wind blows moſt frequently and violently on: for if the current of air is towards the fire, as there is no other vent but the funnel, the room will always be clear of ſmoke. Therefore never let chimnies be in external walls if it can be avoided, nor doors in partitions between rooms, where windows are oppoſite.

Fourthly, be particularly attentive to the ſituation of ſtair-caſes and landing-places. Obſerve to make them as cloſe as poſſible on all ſides, and never let a principal ſtair-caſe have a direct communication with garrets, which are generally ſo open and airy as to occaſion a conſtant and powerful current of air between the lower apartments and the upper, which is ſure to be attended with very diſagreeable circumſtances. If there is no back ſtair-caſe, then the ſtairs to the garret from the higheſt floor, ought to be detached and partitioned from the principal ſtair-caſe, and have no immediate connection or communication therewith.

All back ſtair-caſes for ſervants, leading from the lower offices to the principal floor and apartments, ought to terminate in a cloſe landing place, communicating with the principal ſtair-caſe, paſſage, and rooms belonging to the houſe, through doors opening into each other, and thoſe doors to be hung ſo as to ſhut of themſelves in a neat cloſe manner.

Fifthly, the ſituation of paſſages is an eſſential article, and the architect in planning ought carefully to avoid long paſſages, for where ever they are, they always occaſion a violent current of air, which often affects the whole houſe, and produces ſmoke in every room.

If long paſſages cannot be avoided, obſerve never to let them terminate in a ſtair-caſe, or in a room, or where there is a fire-place, nor to have an open communication with the higher parts of the houſe; and endeavour to have no openings, as doors or windows at the ends of theſe paſſages: for if there are, there will be a briſk ſtream of wind flowing thro' them continually, which will be the cauſe of a long train of evils, beſide that of ſmoke. But if openings muſt be at both ends, make them, if poſſible, on one ſide of the houſe, becauſe then the wind will enter in at both ends at the ſame time, and will, in ſome meaſure, counteract each other. The entrance into theſe paſſages ought to be at one place, the moſt convenient for communication with the principal parts of the houſe, by doors ſecured as before mentioned.

In capital houſes, where there is a neceſſity of having ſeparate paſſages for ſervants, be careful that they have no direct communication with the principal paſſage, or landing-place of the grand ſtair-caſe. Let all thoſe communications be through paſſages with doors to ſhut.

If there are any detached buildings, as wings for offices, and ornaments, contrive the plan, if poſſible, to have no internal communication with the houſe, by any long paſſage, except by a covered way, &c.

Sixthly, the next thing to be carefully avoided is ſmall rooms, particularly for bed chambers, for they are attended with more evil conſequences than is generally imagined.

There are no apartments in a houſe ſo liable to be troubled in this particular as ſmall cloſe rooms, or cloſets ; and none are ſo unhealthful and diſagreeable : for if there is not a ſufficient quantity of freſh air conſtantly admitted into the chamber to ſupply the fire, the air in the room is exhauſted, and becomes lighter than the external air at the top of the chimney ; whereby not maintaining an equilibrium above, the current in the chimney funnel will be inverted, and fill the room with ſmoke.

In this caſe the well known cure is by opening a door, or a window, and admitting freſh air, by which the proper circulation is reſtored ; but this remedy is neither agreeable nor ſafe. For a window is no ſooner opened, than a ſtream of cold air enters, and is diffuſed through the whole room. So that while ſome parts of our bodies are ſcorched with a briſk fire, other parts are numbed with a piercing cold, which is productive of diſagreeable effects in weak conſtitutions.

The worſt evils attend ſmall bed-chambers, for the little quantity of air contained in them (if the fire at bed time burns vigorouſly) is too ſoon warmed, and often heated to an inſupportable degree; and no ſooner is the fire diminiſhed, or put out, than the warm air in the room is immediately ſucceeded by air as cold as the external atmoſphere; ſo that if any part of the body is for a ſhort ſpace of time expoſed to the cold, it is ſuddenly ſeized with ſome violent rheumatic pains, &c.

If the fire is continued all night, and the door and windows ſhut cloſe up, as often happens, where ſickly people repoſe; in this caſe they breathe all night in a confined atmoſphere of ſuffocating air, loaded with the perſpiration of their own bodies, very injurious to the conſtitution.

All inventions for warming rooms by incloſed air, particularly that by clumſy and mournful looking ſtoves, are unwholſome.—Stoves do not promote a diſcharge of air from rooms, which yet is every moment more and more replete with vapours diſperſed from burning candles, the breath and perſpiration of the company, and, occaſionally, from other ſources; whence the air inſpired becomes noxious. Freſh air cannot be duly circulated where ſtoves are uſed; nor can health be maintained where impure air is confined. All this is ſufficiently evident to perſons who will take the trouble to reaſon a little for their own ſakes; but where caprice introduces novelties, *faſhion* is a word, that by a kind of magical influence, too often ſilences every effort to examine into *propriety*.

Large rooms are not liable to thoſe evils, for by the conſtant action of the fire, they are more regularly heated, the air there hath more liberty to expand itſelf; therefore at bed time a more moderate and regular heat is enjoyed, and being long before the warmth abates, its temperature is never in extremes, as ſo often happens in ſmall rooms, which are never favourable to the weak or ſickly.

Again, if there is a ſmall chimney, or even a fire-place, of a ſize proportioned to a ſmall room, and it is duly ſupplied with air from the windows and doors thereto belonging; yet when the door is opened, it will preſs the air within the room in an undulatory manner; and if the door is quickly ſhut, it will often ſo force and draw the air from the fire as inſtantly to fill the room with ſmoke, and even bring the ſoot down with it.

The following experiment will confirm this obſervation; *e. g.* if a ſmall room has two doors opening into it, let one of them be unlatched, and the other opened quickly, the looſe door will ſlap cloſe; and on ſhutting the other door again, it will ſpontaneouſly open.

It is likewiſe demonſtratively clear, that theſe effects take place, leſs or more, in all rooms, in proportion to their ſize. In a large room the quantity of air diſplaced by the door as it ſhuts or opens, is ſo inconſiderable a part of the whole, and the chimney at ſuch a diſtance from it, that the effects produced are ſcarce diſcernible; but in ſmall rooms it is otherwiſe, for there the air is ſo violently determined down the chimney, that the effects are very diſcernible. Again, if a perſon, in a ſmall room, moves ſwiftly towards a fire-place, his change of place will puſh the air before him, and force it up the chimney; and if he retires quickly from the fire, a proportionable quantity is drawn down therefrom, to fill the vacuum left by his body: theſe effects will be proportioned to the perſon's bulk, the celerity of his motion, and the magnitude of the room.

Small chambers are attended with many more inconveniences; but thoſe already recited will, it is imagined, ſufficiently deſcredit them with gentlemen who wiſh to build agreeable manſions.

As ſmoke is often occaſioned in cloſe rooms by the want of a proper ſupply of freſh air, we will juſt mention that the beſt method of conveying air into them, is by ſmall tubes, communicating with the air without; which ingenious workmen may ſo contrive and fix as not to be perceived, and to regulate the draught at pleaſure.

The common practice is to make theſe tubes conduct the air immediately into the fire place, and as low as poſſible; but if this is not done with judgment, it frequently adds to the diſeaſe: in rooms for the reception of company, it is uncomfortable, and even unwholeſome; for if the fire is ſupplied with a ſufficient quantity of air within the chimney jambs, it ſtops the current, and keeps the air in the room in a ſtate of ſtagnation, and thus prevents a free circulation of air in the room.

The moſt perfect and complete manner of executing this operation is, by admitting the air at the top of the room, or in the ceiling, by a tube or pipe leading from thence downwards, either on the outſide or inſide of the building, as the ſituation moſt conveniently admits, and the other end to communicate with the external air. In this caſe, the cold air would force in at the external aperture, aſcend into the room, and gradually mix with the heated air, in an imperceptible manner; diſperſing itſelf through the room to the fire, carrying off the foul ſtagnated air, paſſing the company and candles unfelt and unperceived, conſtantly ſupplying the room with a ſucceſſion of wholeſome ſweet air.

A fire in a well conſtructed chimney in this caſe, will burn with the greateſt life and chearfulneſs; and if the doors and ſaſhes are made to ſhut with due exactneſs, the company will enjoy ſweet, pure, and freſh air. On this account, nothing is more deſirable than open fire places; they perform the part of a perpetual ventilator, and contribute to the health of the ſedantry and recluſe.

Much judgment is required in fixing theſe tubes, or pipes; the ſituation of the chimney, doors, and windows muſt be conſidered with attention, for if they are not properly fixed and executed, bad conſequences will enſue: the ingenious artiſt will obſerve, that the opening of theſe pipes need not be large; they ſhould be ſo conſtructed and fixed as to be regulated, or contracted to any degree, and ſhut cloſe up at pleaſure, which may be done by means of a ſmall ſlider like that to the end of a teleſcope.

We are convinced, and could demonſtrate it clearly, that tubes might be ſo conſtructed in large aſſembly, or concert rooms, &c. for ſome of them to bring the cold freſh air ſucceſſively and conſtantly into the room, without emitting any warm air; and other tubes conſtantly to be emitting the warm, or foul air, out of the room, and not to admit the cold external air into it. Thus, ſuch rooms would be kept clear from all the inconveniences attending crouded aſſemblies, where lamps or candles are abundantly conſumed, and where various other means occaſionally produce unwholeſome changes in the air. Theſe tubes, if rightly conſtructed and executed, will anſwer every purpoſe here required better than any ventilator ever yet propoſed. By the above plan the room will be kept in an equal and moderate degree of heat, and the health of the company guarded from the hazards of inſpiring a ſtagnated, confined, and putrid air.

Cloſe kitchens in baſement ſtories of capital buildings, where large fires are frequently uſed, and which conſume great quantities of air, often ſmoke; the beſt way to cure them is to convey the air immediately into the chimney, and as near the fire as poſſible, by pipes as above propoſed. In kitchens of large manſions, where fires are conſtantly kept, theſe pipes, or tubes may be ſo conſtructed and contrived as to anſwer ſeveral uſeful and valuable purpoſes. By ſuch means water cloſets, cellars, vaults, wells, and drains, &c. may be cleared of foul, ſtagnated air, and kept as ſweet and wholeſome as any room or apartment in the houſe, without ſtink traps, or any other troubleſome machine, or invention.—The utility of which any gentleman may experimentally be convinced of at a very ſmall expence.

A particular diſcuſſion of the above two articles would lead into a very extenſive field of digreſſion, entirely foreign from our original ſubject, of preventing ſmoke in buildings to be erected, and of curing ſmoke in houſes already built. It is hoped that the variety introduced reſpecting internal particulars, will enable our readers to be fully and ſufficiently maſters of this ſubject; we ſhall, therefore, proceed to the third and laſt part, with regard to ſituations and external objects.

Of EXTERNAL OBSTRUCTIONS *from High Buildings, Elevation of Ground, as Hills, the Nature of the Region, and a due Regard from what Points the furious Winds moſtly blow.*

THE choice of a place for building in the country is intereſting in the higheſt degree, for the moſt elegant ſtructure may loſe great part of its value from a bad ſituation.

In all buildings we ſeek convenience and pleaſure; but neither the one nor the other can be obtained, unleſs we properly conſider the place and ſituation of the ſtructure; what conduces to health includes alſo our deſign of avoiding ſmoke, therefore we ſhall ſpeak of them as inſeparable.

In cities and large towns, buſineſs is more regarded than pleaſure; there we are obliged to do what we can, not what we chuſe, particularly if cramped for room.

What comes immediately under our conſideration, as to country ſeats, is the poſition of the houſe, as to the elevation of the ground, and the direction of the winds, ſo as not to obſtruct the aſcent of the ſmoke out of the chimney funnel. As to the other, reſpecting water, ſoil, proſpects, &c. they are foreign to this object.

Air is among the firſt and moſt immediate advantages of ſituations, for in ſearch of that the nobility and gentry fly into the country, for the ſake of health: as on that depends the enjoyment of every other ſatisfaction, particularly if they are ſo happy as to occupy a comfortable houſe free from ſmoke.

For many reaſons a country houſe ſhould ſtand on an eminence: every elevation of ground has the advantage of dryneſs, and a more wholeſome air than flat and hollow places. No damp, ſtagnated moiſture, remains on it, and the air paſſes freely; but extremes in every thing are faulty. A building upon a very high hill has many inconveniences; the air is there too ſharp, hence the ſpot is commonly barren, and the winds have too much power. Though it cannot affect a properly executed chimney at the top, yet if the doors and ſaſhes are not perfectly fitted cloſe, it may cauſe ſuch a current of air in rooms and paſſages oppoſite to its direction, as to occaſion the houſe to ſmoke, particularly if the front door is not well ſecured by a portico, opening into a cloſe lobby. As all external ſhelters are confined to trees, theſe will not grow on mountainous heights; conſequently the moſt elevated ſituations are not the moſt deſirable.

It was the cuſtom of our forefathers to build in bottoms and hollows, to ſhelter and ſcreen their houſes among woods, and between hills; but this is an unhealthy, as well as diſagreeable ſituation; for if the hills and woods are of a greater elevation than the chimney tops, the houſe at times muſt ſmoke, without ſome expedient is contrived to prevent it.— For when a current of wind flows over the top of any high object, as a ſteep hill, a grove of trees, &c. the violence of the current at firſt overcomes the power of the gravity in that direction: but the current ſoon loſing its force, the air is impelled downward by its gravity, hovering in eddies over the chimnies, where meeting the current of vapour in its paſſage, the latter is often forced back into the houſe, and fills it with ſmoke.

The caſe will be the ſame almoſt in every particular where low houſes are contiguous to high buildings; but if the object is not very high, the diſorder may be remedied by elevating the chimney.

If a houſe is ſituated on the declivity or ſlope of a hill, there will be no danger of ſmoke, when the wind blows toward that ſide of the hill on which the houſe was ſituated: for the current of wind riſing with the aſcent of the hill, will powerfully draw the ſmoke upwards from the top of the chimney. But a houſe in this ſituation will be liable to ſmoke, when the wind blows down from the hill; for the current of wind will deſcend in eddies over the chimney as before obſerved, and prevent the ſmoke from aſcending with freedom out of the funnel.

It may not be improper to obſerve here, if the building has wings, to place them on the riſing ground towards the top of the hill, as the beſt ſituation, for the chimnies belonging to them, as well as for other reaſons.

If a houſe is ſituated cloſe under a high rock, ſteep hill, or lofty building, it will be liable to ſmoke when the wind blows towards the ſides of the hill, or building, as well as when it blows over from them: for the wind will flow ſtraight over the top of the low building, and when it meets with the large oppoſing object, it then will be interrupted in its courſe, and reverberate on every ſide. If it can find a paſſage upwards, it will aſcend, carrying the ſmoke of the low building along with it, and flow off in that direction: but if there is any opening below, either a valley, ſtreet, or lane, that will admit it, the power of gravity will bear it downwards with great impetuoſity by that paſſage, in a gradual inflected direction, and meeting the rarefied air and vapour flowing from the chimney, will beat it back, and thereby be liable to cauſe ſmoke.

There are many more external accidents to occaſion ſmoke, either in a leſs or greater degree, in particular ſituations. Such as ſudden and violent blaſts of winds, reflecting from the ſides of hills and mountains, and ruſhing down hollows and vallies, with great rapidity and force; occaſioning in certain places, ſtrong whirlwinds and eddies of different kinds, powers, and directions. Indeed, whatever in any meaſure, obſtructs or diverts the free and natural motion of the wind, is liable to occaſion ſudden guſts, which may produce puffs of ſmoke. Hence it follows that every one who builds, ought to be careful that the ſituation be ſuch that the tops of his chimnies be free and clear from thoſe obſtructions; or elſe he may lay his account to be annoyed with occaſional puffs of ſmoke.

Tops of chimnies executed in a proper manner as deſcribed page 47, will prevent theſe ill conſequences, in all moderate caſes: but there are ſome ſituations ſo much expoſed to ſudden and violent guſts of wind, ſometimes whirling round, and beating down with great force and quickneſs in a ſtraight direction, and ſuddenly up again; that it is a very great difficulty to guard againſt every danger of that kind. It may happen in many caſes, that two or more of the defects abovementioned may be combined together, to augment the malady, which may tend greatly to perplex thoſe who pretend to cure ſmokey chimnies. Yet among all the various ſchemes invented, either one or other of the two following ſimple ones will effectually anſwer the purpoſe of one and all of the laſt abovementioned evils in bad ſituations.

Firſt, make two holes, one over the other on each ſide of the funnel, as high as poſſible, and cover the top cloſe over, but let one of theſe holes go ſloping downward, and the other ſloping upwards, ſo that the ſmoke will always find way through one of them.

Secondly, place an inclined funnel mouth, moving horizontally on a centre, made of ſheet iron, or block tin, on the top of the chimney, to be turned from the wind by a vane: this need not be above two feet high; and, if properly conſtructed, will anſwer the purpoſe effectually.

By theſe principles here laid down, it is plain that an open, elevated place, in town or country, is the beſt ſituation, both for health, proſpect, and convenience, where the air is free and in continual motion, then the ſmoke would aſcend without the leaſt interruption, into the outmoſt atmoſphere.

A ſituation may be very good and agreeable on the ſlope of a moderate eminence, where the ground riſes gently up from the plain, and continues behind the houſe a little: if there are trees for ſhelter from the more diſagreeable ſtrong winds, they will do no harm, provided the tops of the chimnies are clear or above them; but in all ſituations, obſerve that the chimney tops are the higheſt objects.

Let this rule be ſtrictly obſerved by the architect, on the firſt diſpoſition of all buildings; to conſider well the nature of the region, and from what quarter the wind moſt frequently blows. According to this conſideration, let the rooms that fires will be moſt uſed in, be ſituated where the wind has the leaſt power. And as before obſerved, let the chimnies be placed in the internal or partition walls, if poſſible.

Alſo in large houſes, where the apartments are numerous, that they may be diſtributed and uited to the ſeaſons of the year, as well as

for

for their ſeveral uſes. Thus rooms for ſummer may be placed towards the north or eaſt; and winter rooms, towards the ſouth and weſt; becauſe we ſeek coolneſs in ſummer, and in winter as much ſun as poſſible. And that all fronts, or principal doors, be on that ſide of the houſe that the wind blows the leaſt in, and the leſs furiouſly. For want of this early and timely precaution, many principal houſes have always been peſtered with ſmoke, and no art uſed has been able to cure them.

If the ſeveral directions and cautions here given, for the conſtructing and erecting of chimnies—for the true diſtribution and poſition of the ſeveral internal parts—and with regard to external ſituations and objects, &c. be truly obſerved and executed; GENTLEMEN will have little reaſon to apprehend any danger of ſmoke in their houſes.

EXPLANATION of the PLATE, with REMARKS

FIGURE I.

IS the ſection of a ſtack of chimnies five ſtories high, for a firſt rate houſe; repreſenting the opening of the fire places, according to the table of proportions, to the ſize of the rooms; ſhewing the proper method of gathering the wings above the mantle; and the regular direction of the funnels, from the wings to the top of the ſhafts; with the dimenſion of each funnel, and the height of each ſtory, &c. divided as follows.

A. The ſection of a kitchen chimney, in the baſement or lower ſtory, ſuppoſed to be 24 ft. 4 in. in length, 17 ft. 4 in. in breadth, and 10 ft. 6 in. high.

c, *d*, *e*, *f*, Repreſents the fire place, or opening of the chimney; *c*, *d*, the height, 4 ft. 6 in. *d*, *e*, the breadth 5ft. 6 in.

h. the range in the fire place, fixed in a proper manner.

a, *b*, repreſents the proper form and method of gathering the wings, from the mantle piece to the mouth of the funnel; and from hence the true and regular direction of the funnel to the top at *b*.

d, *g*, the height of the gathering of the wings 2 ft.

i, is a ſmall flue for a copper, oven or ſtove, in a proper direction to the principal funnel *a*, *b*.

N. B. We by no means adviſe flues to be laid into funnels, as they often are the occaſion of ſmoke: therefore let them always be avoided if poſſible; but if they muſt be had, never let them go into the funnel horizontally, but always in an inclined direction, above the gathering, as repreſented.

B. The ſection of a proper chimney, on the parlour, or ground floor; the room 18 feet ſquare and 12 feet high.

a, *b*, *c*, *d*, the fire place or opening of the chimney; *a*, *b*, the height 3 ft. 6 in. the breadth; *b* *c*, 3 ft. 5½ in.

b, *e*, the height of the gathering of the wings 1 ft. 4 in. per dotted lines croſs.

e, *f*, the height of the perpendicular direction of the funnel 1 ft. 8 in. ditto.

g, *h*,

g, *b*, the proper direction of the funnel to the top of the chimney.

h, a common ſmall ſtove ſtanding in the fire place, in an imperfect ſtate, being the ſure cauſe of ſmoke. *Vide* page 17.

C. The ſection of a dining room chimney, in the one pair of ſtairs, or principal floor, being 24 feet by 18 feet, and 14 feet high.

r, *o*, *b*, *t*, the opening of the chimney 4 ft. 0½ in. wide, 3 ft. 8½ in. high.

N. B. An addition is made to the height and breadth of the opening, according to the directions in the explanation of the table of proportions, the ceiling being 14 feet high.

c, *l*, the height of the gathering of the chimney wings 1 ft. 4 in.

e, *f*, The height of the perpendicular direction of the funnel 1 ft. 8 in.

g, *b*, the proper direction of the funnel to the top of the chimney.

h, A Bath ſtove properly fixed. *Vide* page 56.

D. The ſection of a chamber chimney, on the two pair of ſtairs floor, 18 feet by 16 feet, and 10 feet high, with the repreſentation of the opening of the chimney, the gathering of the wings, and the direction of the funnel, as before deſcribed.

E. The ſection of a chimney in the garret ſtory, 18 feet by 12 feet, and 9 feet high.

N. B. There is a deduction in the ſize of this chimney, the ceiling being only 9 feet high, according to the directions given in the explanation of the table of proportions.

F. The roof, or ſpace between the garret ceiling floor, and the upper ridge of the roof.

G, H. The ſhafts of the chimney above the roof, finiſhing in the form of a pedeſtal, agreeable to order ; *b, b, b, b, b,* the funnels ; *c, c, c, c,* the partition walls between the funnels, with grooves. *Vide* page 47.

FIGURE II.

The ſection of a chimney and funnel, upon an erroneous conſtruction. *Vide* page 19 and 39.

N. B. The above ill-conſtruction is ſtrongly recommended by Mr. Iſaac Ware, in his

Complete Body of Architecture, and by ſome authors of leſs note.

Figure III.

The ſection of two fire places, and two funnels.—*a*, *b*, *c*, *d*, *e*, *f*, *g*, *h*, in A, is a bad executed and conſtructed funnel. *Vide* page 21 and 40.

c, *d*, in B, is a wrong conſtructed funnel, executed in common by many of the bricklayers, particularly in garrets, and ſmall houſes, and is recommended by ſome old authors. *Vide* page 18.

N. B. When the aperture or wings of the chimney above the mantle is too wide, and not properly contracted, as the above-mentioned funnel; M, N, in the funnel, repreſents two plates of milled iron, fixed level with the lower edge of the mantle to the wall, with neat ſmall hinges, and ſo contrived as to be taken out with eaſe, at pleaſure, to clean and ſweep the chimney.

The moſt perfect way to put them up, is to place one of the plates a little lower than the other, and made ſo long, that the ends ſhould croſs each other as *m*, *n*, by which means every particle of air will be forced to paſs immediately over the fire.

Theſe plates will admit of being raiſed or lowered at pleaſure, by a wire fixed to the upper edge of the plate; either to paſs through a ſmall hole made in the jamb of the chimney to the outſide as at O; or ſo contrived by a pulley, as to come down the inſide of the chimney jamb. It may there be joined to a handle in the form of a bell handle, and by a ſpring with notches, to catch the handle, may be made to raiſe or depreſs the plates without blemiſh or inconvenience to the fire place. By means of theſe plates, the whole force of the fire is neceſſarily brought to act upon the aperture, where they paſs one another; and as no air can enter the funnel, but through that contracted paſſage, it muſt be ſtrongly heated, and will therefore ruſh through quickly to the top of the chimney, for this will occaſion a conſtant and rapid draught of air in the funnel, which is the only means of carrying off the ſmoke with certainty.

If theſe plates are made to fit exactly the ſides of the chimney all round, (when there is no fire uſed) they may be let down cloſe to touch one another, which will anſwer every purpoſe of a ſmoke board, and will intercept any ſoot or dirt, that might otherwiſe drop down the funnel into the fire-place: and if ſmoke at any time is accidentally beat down the chimney by a ſudden guſt of wind, it will be in like manner ſtopped by the plates, from deſcending into the room.

Plates properly conſtructed and fitted with exactneſs and neatneſs, would in many reſpects be of ſervice even to a well conſtructed chimney; for when a fire is firſt kindled, a great quantity of groſs vapour is exhaled, which fills the chimney, and makes room, particularly in the wings, neceſſary; but after the fire begins to burn clear, there is no occaſion for ſo much vacant ſpace, which on many occaſions is attended with inconveniences, as too large a quantity of the heated air is tranſmitted out of the room, and carried off up the chimney, which ought to warm it. Such plates, therefore, properly fixed, would contract or dilate the paſſage of the rarefied air at pleaſure, keep the room always in a proper degree of warmth, and convey the ſmoke away with the greateſt certainty. They may be ſo ordered as to make the fire burn briſk or ſlow, and anſwer every purpoſe of a regulating ſtove, without their diſagreeable appearance and great expence.

When this contrivance is adopted, the back of the chimney, as *g*, *f*, *fig.* 6, and the gathering of the wings, muſt be conſtructed ſquare, and truly executed; as then the plates may be fitted in with great exactneſs, and at pleaſure be drawn up cloſe to the wall, ſo as to leave the opening of the chimney almoſt as clear as if there were none.

In kitchens, where, on particular occaſions, the utmoſt width of the chimney is required, which at other times may be as inconvenient; theſe plates would be found peculiarly ſerviceable, when only a ſmall fire is uſed.

FIGURE IV.

The profile of three chimnies. A. the profile of the kitchen chimney in *fig.* 1.

a, *b*, the gathering of the breaſt of the chimney in a proper manner from the mantle.

c. the profile of the range in the kitchen chimney, anſwering to *b*, in A. *figure* 1. *Vide* page 54.

d, the brick work at the back of ditto.

e, the brick work ſloped off at the back of the chimney above the range.

B. The profile of the parlour chimney in *figure* 1.

a, the mantle on an improper conſtruction.

b, the profile of a common ſtove ſtanding in the fire place, anſwering to *b*, in B. *fig*. 1.

C. The profile of the dining room chimney in C. *figure* 1.

a, *b*, the gathering of the breaſt of the chimney properly.

c, the profile of the ſtove *b*, in the dining room, *figure* 1.

d, *e*, the brick work at the back of ditto.

FIGURE V.

The plan of the aperture of the chimney of the dining room in C. *figure* 1. from the mantle piece *o*, *b*, to *n*, *n*, in ditto.

a, *b*, *c*, *d*, repreſents the gathering of the wings and breaſt in a circular form, beginning immediately at the under edge of the mantle piece at *o*, *b*, *m*, in C. *figure* 1. gathering regularly, to the mouth of the circular funnel, *n*, *n*, in C. *figure* 1. *n*, is the mouth of the circular funnel, which *a*, *b*, *c*, *d*, is to gather to, in a circular regular manner, at 18 inches high, as is repreſented by the dotted lines, in C. *fig.* 1. *Vide* page 41.

N. B. This work will require much more time, care, and attention, (if executed in perfection) than the common bungling method of building chimnies at preſent in practice: and as ſome chimnies from their poſition, and the direction of their funnels, will be more difficult to execute than others, and as workmen have different methods in the execution of them, it is impoſſible to fix a certain value thereon; therefore the beſt way would be, to eſtimate the chimnies, ſeparate from the other parts of the building, by the quantity and quality of the materials uſed, and time expended in the execution thereof.

Note. Theſe chimnies ought to be executed by none but workmen of merit and experience:

perience: and we think it our duty to caution gentlemen, never to ſuffer them to be undertaken by *contract jobbers*, or to be rectified by chimney doctors; for it is contrary to the intereſt of theſe honeſt gentlemen, to execute work well, even if they can, and are well paid for it.

FIGURE VI.

a, *b*, *c*, *d*, the plan of a chimney; *d*, the fire-place or hearth, the jambs coming out from the back, ſquare, or right angles, as *f*, *g*; *e*, *e*, two ſquare funnels. *Vide* page 14 and 36.

FIGURE VII.

k, *l*, *m*, *n*, plan of a chimney; *o*, *p*, *q*, *r*, the fire place or hearth, the jambs ſloping inwards, or coming out from the back in an obtuſe angle, as from *p*, *o*, and *q*, *z*.——*s*, *s*, two proper circular funnels. *Vide* page 38 and 49.

FIGURE VIII.

r, *s*, *t*, *u*, the plan of a chimney; *w*, *y*, *z*, the fire-place, the jambs and back forming the plan of a ſegment of a large circle, or rather an ellipſis. *Vide* page 37.

FIGURE IX.

Is the upper ſhaft of a chimney, terminating the building and finiſhing, in the form of a pedeſtal regularly according to order.

FIGURE X.

Is a chimney ſhaft, with pots fixed on it, which is now become the faſhion in moſt of the new buildings.

Theſe are exhibited to ſhew the contraſt, and effect in point of ſymmetry, according to the rules of architecture: the one being an agreeable finiſhing, the other equally mean and frivolous. Nevertheleſs, ſome ſurveyors, who affect to be architects, have had confidence enough to pronounce, that pots are pretty ornaments on the tops of chimnies. But we have many architects, at preſent, who attempt grand and noble undertakings, and yet only leave behind them laſting monuments of their ignorance.

Some indeed, who have too much modeſty to go all lengths with their brethren, will ſay, that though pots upon chimney tops have a diſagreeable appearance, yet they are in reality found neceſſary in preventing houſes from ſmoaking.

To this I anſwer—Pots are never of ſervice, but where contraction and height in the funnel are required; and being circular, they are in ſuch caſes ſometimes found uſeful: but I have often known them to cauſe ſmoke, and therefore to have been properly taken down; when the chimney has done better without them. —A remarkable inſtance of this may be ſeen at a nobleman's houſe near the ſouth ſide of Berkley ſquare, in a large ſtack of chimnies, conſiſting of eight funnels; where one pot is taken away from a funnel near the middle of the ſhaft, and I am well informed, the chimney hath never ſmoked ſince, though it always ſmoked intolerably before.

Pots are moſtly of a bad conſtruction, being contracted too narrow at top; and their ſloping outwards, cauſes the wet to run down the inſide. The ſoot and rain thus ſoon clog up the orifice of the pot, which obliges the chimnies where they are fixed, to be often ſwept : and the ſweeper ſometimes finds the ſoot ſo congealed, as not to be cleared away without ſcraping off with a knife. From this and other reaſons, the boys are careleſs in ſweeping them properly, being afraid to go up them.

The following circumſtance happened at a gentleman's houſe in the courſe of laſt ſummer—The porter complained that the chimnies were never half ſwept, and told the boy if he did not go up to the top of every pot, and clean them well, he would give him nothing for his trouble ; the lad willing to do his beſt, in ſtruggling and endeavouring to get up the inſide of one, the pot and boy came rolling down the roof, into the middle gutter ; the pot broke, but providentially, the boy eſcaped being hurt.

Chimney pots are very dangerous, if not properly and carefully fixed, which is ſeldom done. There are few high winds happen without inſtances of ſome of them being blown down, and damage done by their fall.

Some years ago, a pot blown off a chimney fell upon the ſky light over a principal ſtair caſe, went through, and broke a valuable chandelier, damaged the hand rail, ſome of the ſteps, and greatly terrified the family.—But a more ſerious accident happened about three years ago, at Mr. Hatchet's in Oxford market; where a boy went up to ſweep the back parlour chimney, which had a pot on it: in endeavouring to clear the congealed ſoot from the top, the pot, and the boy in it, fell down into the back yard upon a heap of rubbiſh. The pot, as may be ſuppoſed, broke to pieces, the lad was taken up for dead, and ſent to the Middleſex hoſpital, where he remained a long time before he recovered; and a maid ſervant waſhing in the yard, was ſo terrified, that ſhe fell into fits, and continued ill for a conſiderable time. Several other accidents might be mentioned from pots being blown off chimneys, therefore they ought always to be avoided; for if a chimney is curable, other remedies may be applied, much more complete and ſafe. To a well conſtructed funnel they are very prejudicial.

In high winds nothing can be more irkſome and diſagreeable to a delicate and ſickly perſon, than the horrible noiſe the wind makes in whiſtling round them, which may be heard in every room of a large houſe. What opinion muſt foreigners form of Engliſh artiſts, when they ſee the chimney tops of royal palaces, public buildings, and moſt of the noble edifices in this metropolis, diſgraced with unſightly and dangerous machinery.

I ſhall juſt conclude with obſerving, that if the preceding directions are ſtrictly followed, all the forementioned evils and inconveniences will be entirely avoided; — and gentlemen may be aſſured, that if the funnels are properly executed and pargetted, they will never be diſturbed with ſmoke, nor their families terrified with alarms of fire, which ſo frequently happen in bad conſtructed chimnies.

I muſt anticipate an objection that may be made, to the difficulty of ſweeping the circular funnels; as it may be urged that by their roundneſs and ſmoothneſs, the boys can have no hold, and will not be able to get up them.—I allow that they will not be ſo eaſily ſwept in this manner as a ſquare funnel: and I ſincerely wiſh for the honour of this nation, that the ſweeping of chimneys by boys was aboliſhed. It is ſhocking to humanity and diſgraceful to a free and civilized nation, to doom poor deſtitute orphans, to that ſlaviſh and cruel employment. Infants who have unhappily loſt their parents, or who are unnaturally deſerted by them, become the children of the public; and it is a ſavage abuſe of truſt, to drive them up theſe loathſome funnels, as ſoon as they acquire the uſe of their tender legs.

The method I would recommend for ſweeping circular funnels is, to have a ſtrong round bruſh, made full to the ſize of the funnel, and about two feet in length, with a ſtaple at each end, for cords to be faſtened to: if this is drawn up and down the chimney by a man at the top and another below, the chimney will be ſwept clean in the moſt perfect manner, as it is practiſed in ſeveral parts in the North of England, where I have been; and, as I am alſo informed, in Scotland and Ireland. A looſe bunch of furze will clean a ſquare funnel equally well.

The ready way to perform this operation, is to drop the lower end of the cord down the chimney, to the man below, with a piece of lead, or a ſtone faſtened to it, and the bruſh to be put in at the top: and ſo pulling up and down by degrees all the way, which will perfectly clean the chimney. If the man below ties his end to a mop-ſtick, he may play it up and down behind a chimney cloth, without injury to his eyes. This method is preferable to ſweeping by boys: for the plaiſtering on the inſide of the funnel will not be hurt by the bruſh; but will be liable to be broke by the boys with their iron ſcrapers and bruſh-heads, who will alſo be tempted to dig holes in the plaiſter for their feet.

The circular funnels will ſeldom want ſweeping, for being ſmooth and regular, the ſoot will not adhere to the ſides, as in the corners of common ſquare funnels: however, no chimney that is uſed ought to remain unſwept once at leaſt in a year. The late act of parliament reſpecting fires in chimneys, dictates this precaution.

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